Signal Analysis/ Prof. Adriano Tort / April 13th, 2021

List of exercises 4

The file LFP_HG_HFO.mat contains simultaneous recordings of 2 LFP channels (in mV) from two different hippocampal layers. These channels were labeled lfpHG and lfpHFO. Sampling rate is 1000 Hz.

Write a script to execute – on different blocks of code – the following:

1) Filter both LFPs on theta (5 to 10 Hz) and gamma (65 to 100 Hz) frequency ranges and store the resulting data in new variables.
2) Compute the amplitude envelope of both filtered signals.
3) Create a figure with two subplots. On (2,1,1) plot the filtered theta signals alongside their amplitude envelopes, and on (2,1,2) do the same for the filtered gamma signals.
4) On different subplots, show scatterplots for all possible combinations of the time series obtained in 2). Display the correspondent linear correlation values as subplot titles.
5) Using lfpHG, plot, without overlapping, the raw signal (non-filtered) as well as both theta and gamma filtered signals alongside their amplitude envelopes. Set X axis limits to 40 and 44 seconds.
6) Compute and plot the amplitude spectrum for both signals (lfpHG and lfpHFO).
7) Compute and plot the continuous time-frequency decomposition (TFD) (i.e., using filters and amplitude envelopes) for both signals.
8) Compute and plot the continuous TFD for both signals using complex Morlet wavelets.